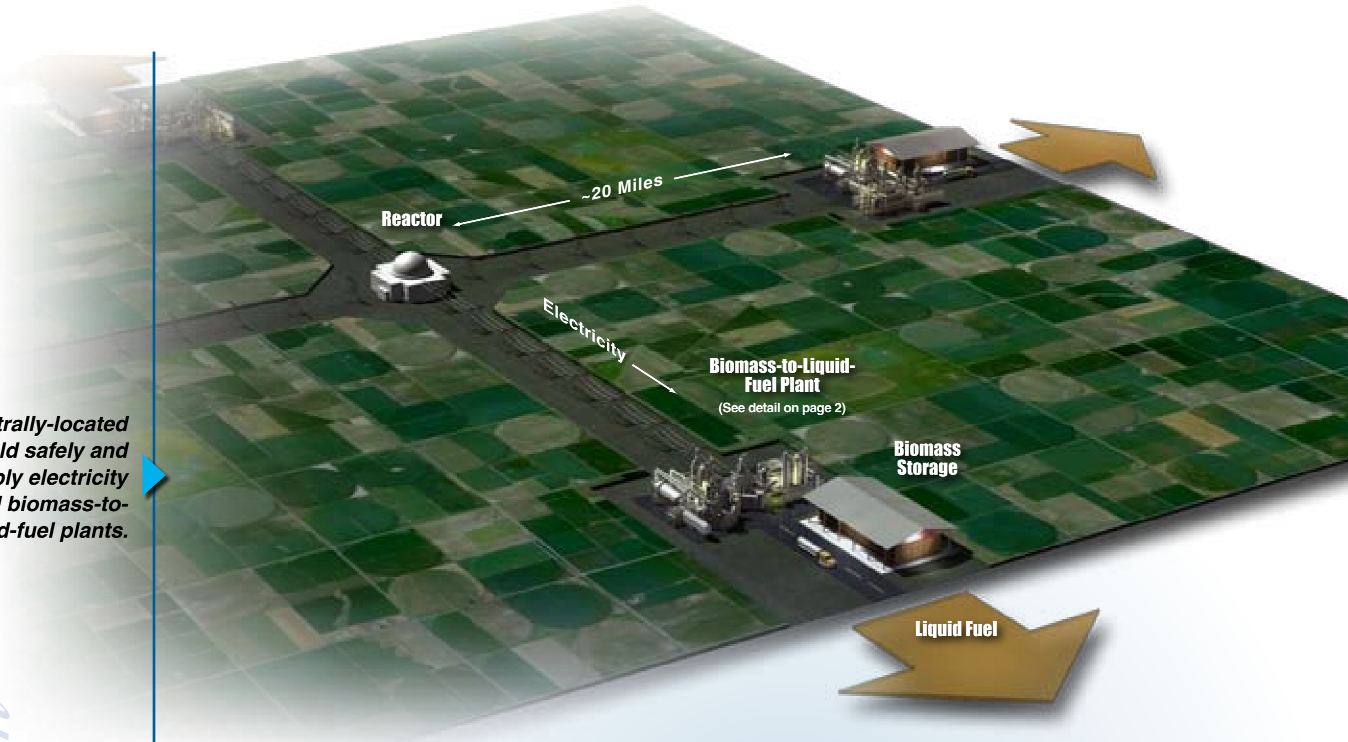

A single, centrally-located reactor could safely and efficiently supply electricity to several biomass-to-liquid-fuel plants.

The Energy of Innovation

Idaho National Laboratory

Bio-Syntrolysis: from Biomass to Liquid Fuel

Research is under way at the US Department of Energy's Idaho National Lab for a promising new technology which, if properly implemented, has the potential to radically change the energy landscape of the United States.

The process, called Bio-Syntrolysis, would convert recyclable biomass (hay, straw, corn stover, wood chips, or other plant waste) into liquid fuel that could be used in cars, trucks and planes. Proponents of Bio-Syntrolysis say that it has a carbon conversion efficiency about 2.5 that of cellulosic or grain ethanol.

Unlike fossil fuels, there is a rich supply of recyclable biomass – 1.3 billion tons available every year. Usually, it is plowed back into the ground, where it is broken down and digested by microbes, thus wasting its stored solar energy. Bio-Syntrolysis could convert the recyclable biomass into synthetic liquid transportation fuel.

To achieve this goal, biomass in the form of crop residue could be harvested from agricultural land area. Cropland would not need to be dedicated to growing biomass because the process can utilize unused crop residue.

Process

Bio-Syntrolysis starts with a fossil-free electrical source, such as nuclear, hydro, wind or solar. Electricity generated from that resource would power the High Temperature Steam Electrolysis (HTSE) process, which would provide a pure stream of hydrogen to supplement the hydrogen-deficient syngas produced via biomass gasification. The HTSE process also produces a pure stream of oxygen to be used in the biomass gasifier. The amount of oxygen fed to the gasifier controls the amount of CO and CO_2 produced. The syngas would then be run through a process that converts syngas into liquid fuels. Each of these technologies has been individually proven, and progress is currently being made to incorporate them into a final Bio-Syntrolysis product.

Bio-Syntrolysis converts the highest amount of biomass into liquid fuel for the least amount of electricity because

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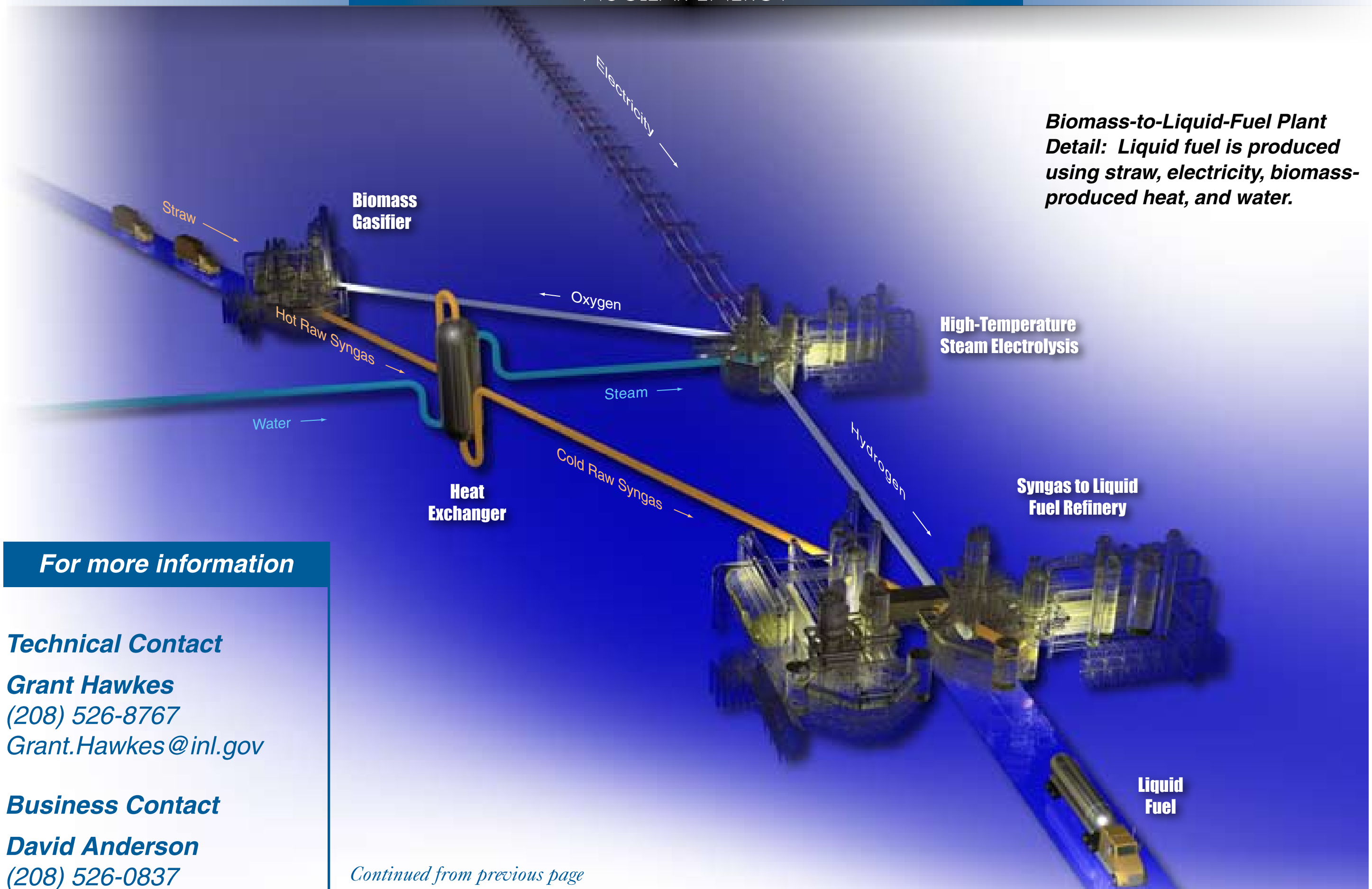

Biomass-to-Liquid-Fuel Plant Detail: Liquid fuel is produced using straw, electricity, biomass-produced heat, and water.

For more information

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Continued from previous page

of the high efficiency of HTSE. Ideally, Bio-Syntrolysis centers could be built around nuclear plants for shorter transfer of electricity. The large input of electricity into the electrolysis step of the process means that Bio-Syntrolysis converts 90 percent of the carbon in the biomass into liquid fuels, whereas cellulosic ethanol converts only 35 percent. In the Bio-Syntrolysis process, the biomass provides the heat source for the HTSE and the carbon source for the syngas. This process is carbon-neutral and renewable with a nonfossil electrical source.

A Model for the U.S.

INL researchers have identified several goals to work towards realizing a future fueled by biomass.

- Locate Bio-Syntrolysis plants regionally, close to where the biomass is grown.
- Use nonfossil fuel electrical power for Bio-Syntrolysis plants.
- Use heat from the biomass gasification as a heat source for HTSE.
- Use biomass as the syngas carbon source.
- Operate continuously to produce syngas.
- Transport liquid fuels for refining into usable fuel.
- License technology with industrial partner.

Status

Modeling and economic analysis began in May 2008. That research is expected to continue through Fiscal Year 2009. A patent for Bio-Syntrolysis is pending at the U.S. Patent Office.

Obstacles

Several barriers need to be overcome before Bio-Syntrolysis technology can be commercially deployed. The HTSE process will require additional funding to support research and modeling to complete development. INL is currently soliciting interest from industry and other government entities to complete development of this technology.

Economics

A preliminary, yet thorough economic analysis shows synthetic, liquid, no-sulphur diesel with a production cost of $2.50 per gallon.

Future

Ideally, INL would institute a large program dedicated to Bio-Syntrolysis research. A pilot-scale plant could be built in southeastern Idaho. Bio-Syntrolysis research needs immediate support if it is to reach its full potential in a timely manner.